

AMENDMENTS TO THE CLAIMS

1-10. (Canceled)

11. (Currently Amended) ~~The method of claim 8,~~ A method of optical imaging comprising:

_____ providing a sample to be imaged;

_____ measuring and correcting aberrations associated with the sample using adaptive optics;

_____ and imaging the sample by optical coherence tomography (OCT);

_____ wherein the aberrations associated with the sample are measured and corrected by (i) illuminating the sample with a point source light beam having a wavefront, (ii) detecting the wavefront of the point source light beam that is reflected from the sample with a wavefront sensor to measure wavefront distortions of the sample, and (iii) adjusting a wavefront corrector so as to compensate for the wavefront distortions that are associated with the sample;

_____ wherein the sample is imaged by (iv) generating a beam of low temporal coherence two-dimensional (2D) OCT light from a light source, (v) splitting the beam of low temporal coherence light to create a sample light beam and a reference light beam, each having an optical path length corresponding to a coherence gate position at a desired region of the sample to be imaged, (vi) illuminating the sample with the sample light beam, (vii) illuminating a reference mirror with the reference light beam, (viii) superimposing the reflected sample light beam and reflected reference light beam to obtain an interference pattern corresponding to the coherence gate position, (ix) recording the interference pattern using a detector, (x) generating a two-dimensional image of the sample from the interference pattern; and

wherein steps (i)-(iii) are ~~RU ther~~ carried out concurrently with steps (iv)-(ix).

12. (Currently Amended): ~~The method of claim 8,~~ A method of optical imaging comprising:

providing a sample to be imaged;

measuring and correcting aberrations associated with the sample using adaptive optics;

and imaging the sample by optical coherence tomography (OCT);

wherein the aberrations associated with the sample are measured and corrected by (i) illuminating the sample with a point source light beam having a wavefront, (ii) detecting the wavefront of the point source light beam that is reflected from the sample with a wavefront sensor to measure wavefront distortions of the sample, and (iii) adjusting a wavefront corrector so as to compensate for the wavefront distortions that are associated with the sample;

wherein the sample is imaged by (iv) generating a beam of low temporal coherence two-dimensional (2D) OCT light from a light source, (v) splitting the beam of low temporal coherence light to create a sample light beam and a reference light beam, each having an optical path length corresponding to a coherence gate position at a desired region of the sample to be imaged, (vi) illuminating the sample with the sample light beam, (vii) illuminating a reference mirror with the reference light beam, (viii) superimposing the reflected sample light beam and reflected reference light beam to obtain an interference pattern corresponding to the coherence gate position, (ix) recording the interference pattern using a detector, (x) generating a two-dimensional image of the sample from the interference pattern; and

wherein the method ~~in the~~ further comprises tracking and compensating for axial motion of the sample by:

generating a beam of low temporal coherence 1D-OCT light from a light source,

splitting the beam of low temporal coherence 1D-OCT light to create a 1DOCT sample

light beam and a 1D-OCT reference light beam, each having an optical path-length corresponding to a coherence gate position at a desired region of the sample to be imaged,

illuminating the sample with the 1D-OCT sample light beam,

illuminating the reference mirror with the 1D-OCT reference light beam,

superimposing the reflected sample light beam and reflected reference light beam to obtain an interference pattern corresponding to the coherence gate position,

recording a series of interference patterns corresponding to a series of coherence gate positions using a 1D-OCT detector,

determining a change in axial position of the sample by analyzing the interference patterns recorded by the 1D-OCT detector,

and adjusting the optical path length of the reference light beam so as to axially move the coherence gate position of the sample light beam thereby compensating for the measured axial motion of the sample.

13. (Original) The method of claim 12, wherein the method of tracking and compensating for axial motion of the sample is completed prior to step (ix).

14. (Original) The method of claim 12, wherein the method of tracking and compensating for axial motion of the sample is carried out prior to and concurrently with steps (iv)-(ix).

15. (Original) The method of claim 12, wherein the sample is an eye and the change in axial position is analyzed using a portion of the 1 D-OCT low temporal coherence light that is reflected off of a region of the eye selected from the group consisting of a choroid layer, a retinal

pigment epithelium layer, and a front layer of a retina.

16-35. (Canceled)

36 (Currently Amended) ~~The apparatus of claim 22, further comprising~~ An optical imaging apparatus comprising:

an adaptive optics (AO) subsystem;

a two-dimensional optical coherence tomography (2D-OCT) subsystem; and

a one-dimensional optical coherence tomography (1D-OCT) axial scanning subsystem comprising a low temporal coherence 1D-OCT light source and a 1D-OCT detector.

37-38. (Canceled):

39. (Currently Amended): ~~The apparatus of claim 38,~~ An optical imaging apparatus comprising:

an adaptive optics (AO) subsystem;

a two-dimensional optical coherence tomography (2D-OCT) subsystem; and

a low coherence flood illumination light source;

wherein the low coherence flood illumination light source is selected from the group consisting of a laser diode, a femtosecond laser, a mode-locked solid state laser, a dye laser, a superluminescent diode, and a light emitting diode; and

wherein the low coherence flood illumination light source is coupled to a multi-mode fiber.

40. (Currently Amended): A method of optically imaging a sample comprising:
correcting aberrations associated with the sample by:

- (i) illuminating the sample with a point source light beam having a wavefront,
- (ii) detecting the wavefront of the point source light beam that is reflected from the sample with a wavefront sensor to measure wavefront distortions of the sample, and
- (iii) adjusting a wavefront corrector so as to compensate for the wavefront distortions that are associated with the sample; tracking axial motion of the sample by:
 - (iv) generating a beam of low temporal coherence 1D-OCT light from a light source,
 - (v) splitting the beam of low temporal coherence 1D-OCT light to ~~create a 1D-OCT sample light beam and a 1D-OCT reference light beam, each having an~~ create a 1D-OCT sample light beam and a 1D-OCT reference light beam, each having an optical path length corresponding to a coherence gate position at a desired region of the sample to be imaged,
 - (vi) illuminating the sample with the 1D-OCT sample light beam,
 - (vii) illuminating the reference mirror with the 1D-OCT reference light beam,
 - (viii) superimposing the reflected sample light beam and reflected reference light beam to obtain an interference pattern corresponding to the coherence gate position,
 - (ix) recording a series of interference patterns corresponding to a series of coherence gate positions using a 1D-OCT detector,
 - (x) determining a change in axial position of the sample by analyzing the interference patterns recorded by the 1D-OCT detector, and
 - (xi) adjusting the optical path length of the reference light beam so as to axially move the coherence gate position of the Sample light beam thereby compensating for the measured axial motion of the sample; targeting a region of the sample to be imaged by:

(xii) illuminating the sample with a low coherent flood illumination light source to focus on a region of the sample,

(xiii) detecting the low coherent flood illumination light that is reflected from the sample with a low coherent flood illumination light detector, and

(xiv) optionally adjusting the focus within the sample to image at a plurality of depths in the sample; and producing an optical image of the sample by:

(xv) generating a beam of low temporal coherence 2D-OCT light from a light source,

(xvi) splitting the beam of low temporal coherence light to create a sample light beam and a reference light beam, each having an optical path length corresponding to a coherence gate position at a desired region of the sample to be imaged,

(xvii) illuminating the sample with the sample light beam,

(xviii) illuminating a reference mirror with the reference light beam,

(xix) superimposing the reflected sample light beam and reflected reference light beam to obtain an interference pattern corresponding to the coherence gate position,

(xx) recording the interference pattern using a 2D-OCT detector, and

(xxi) generating a two-dimensional image of the sample from the interference pattern.

41. (Currently Amended) An optical imaging apparatus comprising (a) a point light source for adaptive optics, (b) a Shack-Hartmann wavefront sensor, (c) a wavefront corrector, (d) a low temporal coherent superluminescent diode 2D-OCT light source, (e) a beam splitter, (f) a reference mirror, (g) a means of modulating an optical path length of a reference beam, (h) a 2D-OCT CCD detector, (i) a 1D-OCT low temporal coherence superluminescent diode light source, (j) a 1D-OCT detector, and (k) a low coherent flood illumination light source coupled to a multi-mode fiber.

42-43. (Canceled)

44. (Currently Amended) ~~The method of claim 43,~~ A method for optically imaging a sample of retinal or fundus tissue in an eye, the method comprising:

- (a) providing an optical imaging system comprising an adaptive optical element;
- (b) measuring wavefront aberrations in the eye;
- (c) controlling the adaptive optical element to correct the wavefront aberrations measured in step (b);
- (d) performing a first optical coherence tomography operation on the sample to determine a distance from the sample to the optical imaging system;
- (e) adjusting the optical imaging system to compensate for the distance determined in step (d); and
- (f) performing a second optical coherence tomography operation on the sample to image the sample;

wherein the second optical coherence tomography operation is a two-dimensional optical coherence tomography operation; and

wherein the first optical coherence tomography operation is a one-dimensional optical coherence tomography operation.

45-48. (Canceled)

49. (Currently Amended) ~~The method of claim 48,~~ A method for optically imaging a sample of retinal or fundus tissue in an eye, the method comprising:

- (a) providing an optical imaging system comprising an adaptive optical element;
- (b) measuring wavefront aberrations in the eye;
- (c) controlling the adaptive optical element to correct the wavefront aberrations measured in step (b);
- (d) illuminating the sample with low coherent flood illumination light;
- (e) detecting the low coherent flood illumination light reflected from the sample; and
- (f) adjusting a focus of the optical imaging system in accordance with the low coherent flood illumination light detected in step (e); and
- (g) performing an optical coherence tomography operation on the sample to image the sample;
- wherein a single detector in the optical imaging system is used to perform steps (e) and (g); and

wherein step (d) is performed with a light source coupled to a multimode optical fiber.

50. (Previously Presented) The method of claim 49, wherein the light source comprises a laser diode.

51. (Previously Presented) The method of claim 49, wherein the light source comprises a superluminescent diode.

52. (Previously Presented) A method for optically imaging a sample of retinal or fundus tissue in an eye, the method comprising:

- (a) providing an optical imaging system comprising an adaptive optical element;
- (b) measuring wavefront aberrations in the eye;

(c) controlling the adaptive optical element to correct the wavefront aberrations measured in step (b);

(d) illuminating the sample with low coherent flood illumination light by using a light source coupled to a multimode optical fiber;

(e) detecting the low coherent flood illumination light reflected from the sample; and

(f) adjusting a focus of the optical imaging system in accordance with the low coherent flood illumination light detected in step (e); and

(g) performing an optical coherence tomography operation on the sample to image the sample.

53. (Previously Presented) The method of claim 52, wherein the light source comprises a laser diode.

54. (Previously Presented) The method of claim 52, wherein the light source comprises a superluminescent diode.

55. (Canceled)

56. (Currently Amended) ~~The method of claim 55;~~ A method for optically imaging a sample of retinal or fundus tissue in an eye, the method comprising:

(a) providing an optical imaging system comprising an adaptive optical element;

(b) measuring wavefront aberrations in the eye;

(c) controlling the adaptive optical element to correct the wavefront aberrations measured in step (b); and

(d) performing an optical coherence tomography operation on the sample to image the sample, wherein step (d) is performed using an active pixel array;

wherein step (d) comprises beat frequency detection.